

# PATENT ABSTRACTS OF JAPAN

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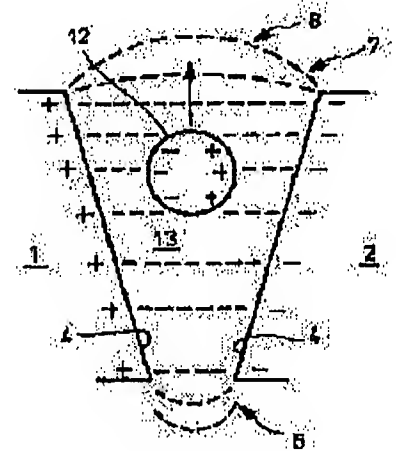
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## (54) AIR BUBBLE REMOVING DEVICE

### (57)Abstract:

**PURPOSE:** To take out only a liquid by certainly removing an air bubble from the liquid in a container.

**CONSTITUTION:** When a liquid 13 is supplied to the space between gradient electric field generating electrodes 1, 2 mutually different in polarity, the air bubble 12 mixed with the liquid 13 in a fluid container is subjected to dielectric polarization by the gradient electric field 8 generated between the electrodes 1, 2 and dielectric migration force acts on the air bubble 12 subjected to dielectric polarization and the air bubble 12 is moved to a weak electric field part 7 to be separated from the liquid 13. Air is discharged outside from the air discharge port provided on the side of the weak electric field part 7 and the liquid from which the air bubble is removed can be discharged to the outside from the liquid discharge port provided on the side of a strong electric field part 6.



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CLAIMS

[Claim(s)]

[Claim 1] While keeping and arranging spacing, the electrode for inclination electric-field generating of a pair with which polarities differ mutually The ramp to which mutual spacing becomes large as it progresses to the phase opposed face of this electrode for inclination electric-field generating from 1 side to the side else is formed. Generating of the inclination electric field from which said 1 side serves as the strong electric-field section the inter-electrode one for inclination electric-field generating, and the side else serves as the weak electric-field section is enabled. Stop a perimeter inter-electrode [ for / said / inclination electric-field generating ], constitute a fluid container, and mostly, while preparing the liquid input of the liquid feeder current way of the strong electric-field section of this fluid container, and the weak electric-field section which makes the liquid from the outside flow into the mid-position The cellular stripper characterized by preparing the gas exhaust port of the gas outflow way which makes a gas discharge to the exterior the liquid outlet of the liquid outflow way which makes cellular removal liquid discharge to a weak electric-field section side again in the exterior in the location by the side of the strong electric-field section of a fluid container.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to a cellular stripper.

[0002]

[Description of the Prior Art] For example, it is maintained at a condition [ a such / automatically / separation phenomenon not happening, since buoyancy does not act on air bubbles in space, although air bubbles will go up to an oil level by buoyancy since buoyancy acts on air bubbles on the ground when the liquid which air bubbles mixed is held in a container, and it will dissociate from a liquid automatically, but having mixed air bubbles in a liquid ].

[0003] Therefore, air bubbles are certainly separated from the liquid in a container, and it is necessary to enable it to take out only a liquid in space.

[0004]

[Problem(s) to be Solved by the Invention] Thus, since there was no cellular stripper which can separate air bubbles from the liquid in a container certainly conventionally in space, and can take out only a liquid For example, since air bubbles could not be separated from a refrigerant but subsequent mixing moreover came to accumulate air bubbles with while when air bubbles were mixed in the refrigerant through which it circulates to the inside of a plane as an object for cooling in the space station etc., there was a problem of it becoming impossible to fully achieve the function of a refrigerant.

[0005] In view of the above-mentioned actual condition, this invention separates air bubbles from the liquid in a container certainly, and aims at offering the cellular stripper which can take out only a liquid even in space or the ground.

[0006]

[Means for Solving the Problem] While keeping and arranging spacing, this invention the electrode for inclination electric-field generating of a pair with which polarities differ mutually The ramp to which mutual spacing becomes large as it progresses to the phase opposed face of this electrode for inclination electric-field generating from 1 side to the side else is formed. Generating of the inclination electric field from which said 1 side serves as the strong electric-field section the inter-electrode one for inclination electric-field generating, and the side else serves as the weak electric-field section is enabled. Stop a perimeter inter-electrode [ for / said / inclination electric-field generating ], constitute a fluid container, and mostly, while preparing the liquid input of the liquid feeder current way of the strong electric-field section of this fluid container, and the weak electric-field section which makes the liquid from the outside flow into the mid-position The cellular stripper characterized by preparing the gas exhaust port of the gas outflow way which makes a gas discharge to the exterior the liquid outlet of the liquid outflow way which makes cellular removal liquid discharge again at a weak electric-field section side in the exterior in the location by the side of the strong electric-field section of a fluid container is started.

[0007]

[Function] The operation of this invention is as follows.

[0008] If the mid-position is supplied mostly, electric field will be generated the inter-electrode one for inclination electric-field generating, the inter-electrode one for inclination electric-field generating from which a polarity differs mutually -- the liquid from the outside -- the strong electric-field section of the liquid input of a liquid feeder current way to a fluid container, and the weak electric-field section -- by this electric field Although the dielectric polarization of the air bubbles mixed in the liquid in a fluid container is carried out Since the 1 side to which spacing inter-electrode [ for inclination electric-field generating ] is narrow serves as the strong electric-field section, and spacing is large and also said electric field are inclination electric field from which a side serves as the weak electric-field section. The dielectrophoresis force acts on the air bubbles by which dielectric polarization was carried out, and air bubbles are moved to a weak electric-field section side by this electrophoretic force, and it dissociates from a liquid according to it.

[0009] Therefore, it becomes possible to make a gas discharge to the exterior certainly through a gas outflow way from the gas exhaust port prepared in the weak electric-field section side, and to make it discharge to the exterior certainly as cellular removal liquid through a liquid outflow way from the liquid outlet prepared in the strong electric-field section side.

[0010]

[Example] Hereafter, the example of this invention is explained, referring to a drawing.

[0011] Drawing 1 - drawing 7 are one example of this invention.

[0012] While it is parallel, and placing the electrodes 1 and 2 for inclination electric-field generating of a long pair and arranging spacing The ramp 4 to which mutual spacing becomes large as it progresses to the side else from crosswise 3 1 side of the electrodes 1 and 2 for inclination electric-field generating is formed in the phase opposed face of these electrodes 1 and 2 for inclination electric-field generating. It may be made to make it generate the inclination electric field 8 from which the power unit 5 of an alternating current or a direct current is connected to the electrodes 1 and 2 for inclination electric-field generating so that mutual polarities may differ, said 1 side serves as the strong electric-field section 6 between the electrode 1 for inclination electric-field generating, and 2, and the side else serves as the weak electric-field section 7.

[0013] And the fluid container 11 is constituted by stopping the perimeter between said electrode 1 for inclination electric-field

generating, and 2 using an end plate 9 and a side plate 10.

[0014] The liquid input 15 of the liquid feeder current way 14 into which the liquid 13 of the strong electric-field section 6 of this fluid container 11 and the weak electric-field section 7 with which the air bubbles 12 from the outside were mixed is made to flow is mostly established in the mid-position.

[0015] Moreover, the liquid outlet 18 of the liquid outflow way 17 which makes cellular removal liquid 16 discharge is formed in the exterior in the location by the side of the strong electric-field section 6 of the fluid container 11, and the gas exhaust port 21 of the gas outflow way 20 which makes a gas 19 discharge to the exterior is formed in the weak electric-field section 7 side.

[0016] Furthermore, the grid-like member 22 with the fine eye of insulating material nature is inserted in the weak electric-field section 7 of the fluid container 11.

[0017] In addition, it is the interface of a liquid 13 and a gas 19. [ in / 23, and / in 24 / the interior of the fluid container 11 ] [ the longitudinal direction of the electrodes 1 and 2 for inclination electric-field generating ]

[0018] Next, actuation is explained.

[0019] a power unit 5 -- using -- the electrodes 1 and 2 for inclination electric-field generating -- an electrical potential difference -- impressing -- this condition -- the liquid 13 from the outside -- the strong electric-field section 6 of the liquid input 15 of the liquid feeder current way 14 to the fluid container 11, and the weak electric-field section 7 -- the mid-position is supplied mostly.

[0020] Then, although the dielectric polarization of the air bubbles 12 mixed in the liquid 13 in the fluid container 11 is carried out as electric field are generated between the electrode 1 for inclination electric-field generating, and 2 and this electric field show to drawing 5 Since the 1 side to which spacing between the electrode 1 for inclination electric-field generating and 2 is narrow serves as the strong electric-field section 6, and spacing is large and also said electric field are the inclination electric field 8 from which a side serves as the weak electric-field section 7, The dielectrophoresis force acts on the air bubbles 12 by which dielectric polarization was carried out, and air bubbles 12 are moved to the weak electric-field section 7 side by this electrophoretic force, and it dissociates from a liquid 13 according to it.

[0021] Thus, the collection of the separated air bubbles 12 is carried out by the fine eye of the grid-like member 22 prepared in the weak electric-field section 7 side.

[0022] Then, in space, when there is no grid-like member 22, as shown in drawing 7, although it is the spherical surface-like, and it will be in an unstable condition and drawing of a gas 19 becomes difficult with surface tension, the interface 24 of a gas 19 and a liquid 13 Since the interface 24 which was almost flat and was stabilized by forming the grid-like member 22 is obtained, it becomes possible to make a gas 19 discharge to the exterior certainly through the gas outflow way 20 from the gas exhaust port 21 prepared in the weak electric-field section 7 side.

[0023] On the other hand, it becomes possible [ air bubbles 12 ] to make cellular removal liquid 16 discharge to the exterior certainly through the liquid outflow way 17 from the liquid outlet 18 prepared in the strong electric-field section 6 side of the liquid 13 from which air bubbles 12 were removed, since it gathers for the strong electric-field section 6 side in response to the electrophoretic force of an opposite direction.

[0024] Moreover, since turbulence arises in line of electric force as shown in drawing 5, the direction which took the large dimension of the longitudinal direction 23 of the electrodes 1 and 2 for inclination electric-field generating and the cross direction 3 can be stabilized more, and can make air bubbles 12 remove in the edge and flank of the electrodes 1 and 2 for inclination electric-field generating.

[0025] In addition, as for this invention, it is needless to say that modification can be variously added within limits which are not limited only to an above-mentioned example and do not deviate from the summary of this invention.

[0026]

[Effect of the Invention] As explained above, according to the cellular stripper of this invention, air bubbles are certainly separated from the liquid in a container, and the outstanding effectiveness that only a liquid can be taken out can be done so.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings.]

[Drawing 1] It is the side elevation which one example of this invention fractured.

[Drawing 2] It is the II-II view Fig. of drawing 1.

[Drawing 3] It is the III-III view Fig. of drawing 1.

[Drawing 4] It is the perspective view of the electrode for inclination electric-field generating.

[Drawing 5] It is the actuation Fig. showing signs that air bubbles are moved by dielectrophoresis.

[Drawing 6] It is the side elevation showing the situation of the vapor-liquid interface at the time of preparing a grid-like member.

[Drawing 7] It is the side elevation showing the situation of the vapor-liquid interface when not preparing a grid-like member.

[Description of Notations.]

1 Two Electrode for inclination electric-field generating

4 Ramp

6 Strong Electric-Field Section

7 Weak Electric-Field Section

8 Inclination Electric Field

11 Fluid Container

13 Liquid

14 Liquid Feeder Current Way

15 Liquid Input

16 Cellular Removal Liquid

17 Liquid Outflow Way

18 Liquid Outlet

20 Gas Outflow Way

21 Gas Exhaust Port

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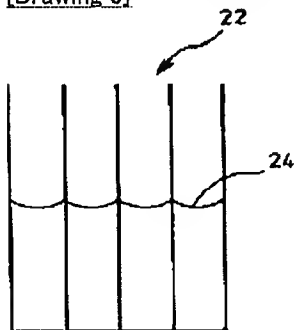
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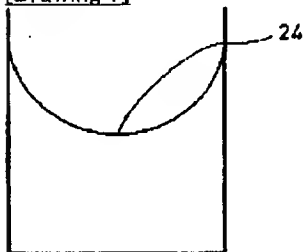
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**DRAWINGS**

[Drawing 6]

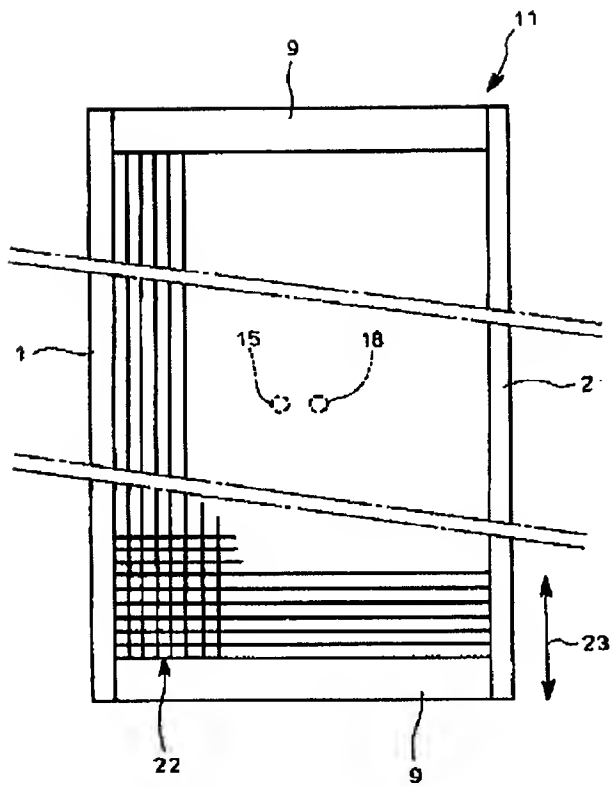


[Drawing 7]

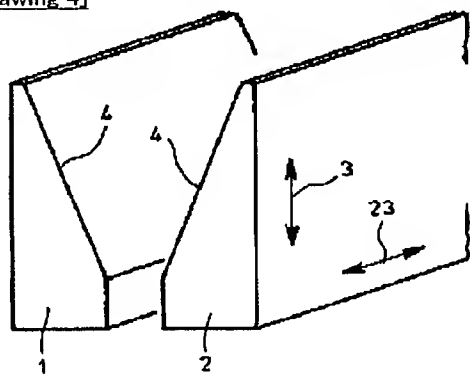


[Drawing 1]

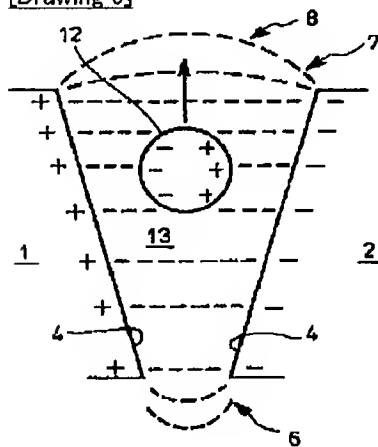




[Drawing 4]



[Drawing 5]





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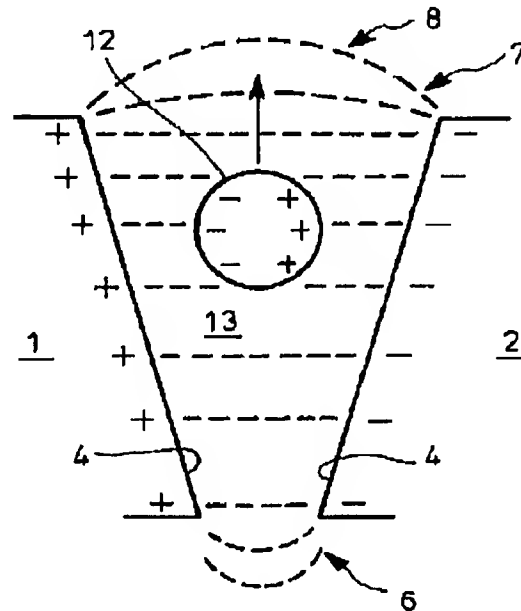
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(54)【発明の名称】 気泡除去装置

(57)【要約】

【目的】 容器内の液体から気泡を確実に分離して、液体のみを取り出すことができるようにする。

【構成】 互いに極性の異なる勾配電界発生用電極1, 2間に液体13を供給すると、勾配電界発生用電極1, 2間に発生された勾配電界8によって、流体容器内の液体13に混入された気泡12が誘電分極され、誘電分極された気泡12に誘電泳動力が作用して、気泡12が弱電界部側へ移動されて、液体13から分離されるので、弱電界部7側に設けられた気体排出口から気体を外部へ排出させ、強電界部6側に設けられた液体排出口から気泡除去液を外部へ排出させることが可能となる。



## 【特許請求の範囲】

【請求項 1】 互いに極性の異なる一対の勾配電界発生用電極を間隔を置いて配置すると共に、該勾配電界発生用電極の相対向面に一側から他側へ進むに従い互いの間隔が広くなる傾斜部を形成して、勾配電界発生用電極間に前記一側が強電界部となり、他側が弱電界部となる勾配電界を発生可能とし、前記勾配電界発生用電極間の周囲を閉止して流体容器を構成し、該流体容器の強電界部と弱電界部のほぼ中間位置に外部からの液体を流入させる液体供給流路の液体流入口を設けると共に、流体容器の強電界部側の位置に外部へ気泡除去液を排出させる液体排出流路の液体排出口を、又、弱電界部側に外部へ気体を排出させる気体排出流路の気体排出口を設けたことを特徴とする気泡除去装置。

## 【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、気泡除去装置に関するものである。

【0002】

【従来の技術】 例えば、気泡が混入した液体が容器に收容された場合、地上では気泡に浮力が作用するので、気泡は浮力によって液面へ上昇し自然に液体から分離されてしまうが、宇宙空間では気泡に浮力が作用しないので、自然にはこのような分離現象が起こらず、気泡は液体に混入したままの状態に保たれる。

【0003】 従って、宇宙空間では、容器内の液体から気泡を確実に分離して、液体のみを取り出すことができるようにする必要がある。

【0004】

【発明が解決しようとする課題】 このように、従来は、宇宙空間で容器内の液体から気泡を確実に分離して、液体のみを取り出すことのできる気泡除去装置がなかったもので、例えば、宇宙ステーションなどで冷却用として機内に循環されている冷媒に気泡が混入された場合、冷媒から気泡を分離することができず、しかも、その後の混入によって気泡が蓄積される一方となるので、冷媒の機能を十分に果せなくなるという問題があった。

【0005】 本発明は、上述の実情に鑑み、宇宙空間でも地上でも、容器内の液体から気泡を確実に分離して、液体のみを取り出すことのできる気泡除去装置を提供することを目的とするものである。

【0006】

【課題を解決するための手段】 本発明は、互いに極性の異なる一対の勾配電界発生用電極を間隔を置いて配置すると共に、該勾配電界発生用電極の相対向面に一側から他側へ進むに従い互いの間隔が広くなる傾斜部を形成して、勾配電界発生用電極間に前記一側が強電界部となり、他側が弱電界部となる勾配電界を発生可能とし、前記勾配電界発生用電極間の周囲を閉止して流体容器を構成し、該流体容器の強電界部と弱電界部のほぼ中間位置

に外部からの液体を流入させる液体供給流路の液体流入口を設けると共に、流体容器の強電界部側の位置に外部へ気泡除去液を排出させる液体排出流路の液体排出口を、又、弱電界部側に外部へ気体を排出させる気体排出流路の気体排出口を設けたことを特徴とする気泡除去装置にかかるものである。

【0007】

【作用】 本発明の作用は以下の通りである。

【0008】 互いに極性の異なる勾配電界発生用電極間に外部からの液体を、液体供給流路の液体流入口から流体容器の強電界部と弱電界部のほぼ中間位置に供給すると、勾配電界発生用電極間には電界が発生され、該電界によって、流体容器内の液体に混入された気泡が誘電分極されるが、前記電界は、勾配電界発生用電極間の間隔が狭くなっている一側が強電界部となり、間隔が広がっている他側が弱電界部となる勾配電界であるため、誘電分極された気泡に誘電泳動力が作用し、該電気泳動力によって気泡が弱電界部側へ移動されて、液体から分離される。

【0009】 従って、弱電界部側に設けられた気体排出口から気体排出流路を介して気体を確実に外部へ排出させ、強電界部側に設けられた液体排出口から液体排出流路を介して気泡除去液として確実に外部へ排出させることが可能となる。

【0010】

【実施例】 以下、本発明の実施例を図面を参照しつつ説明する。

【0011】 図1～図7は、本発明の一実施例である。

【0012】 平行で且つ長尺の一対の勾配電界発生用電極1、2を間隔を置いて配置すると共に、該勾配電界発生用電極1、2の相対向面に、勾配電界発生用電極1、2の幅方向3一側から他側へ進むに従い互いの間隔が広くなる傾斜部4を形成し、勾配電界発生用電極1、2に、互いの極性が異なるよう交流、或いは、直流の電源装置5を接続して、勾配電界発生用電極1、2間に前記一側が強電界部6となり、他側が弱電界部7となる勾配電界8を発生させ得るようにする。

【0013】 そして、前記勾配電界発生用電極1、2間の周囲を、端板9及び側板10を用いて閉止することにより、流体容器11を構成する。

【0014】 該流体容器11の強電界部6と弱電界部7のほぼ中間位置に、外部からの気泡12が混入された液体13を流入させる液体供給流路14の液体流入口15を設ける。

【0015】 又、流体容器11の強電界部6側の位置に外部へ気泡除去液16を排出させる液体排出流路17の液体排出口18を設け、弱電界部7側に外部へ気体19を排出させる気体排出流路20の気体排出口21を設ける。

【0016】 更に、流体容器11の弱電界部7に、絶縁

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材性の目の細かい格子状部材22を挿入する。

【0017】尚、23は勾配電界発生用電極1、2の長手方向、24は流体容器11の内部における液体13と気体19との境界面である。

【0018】次に、作動について説明する。

【0019】電源装置5を用いて、勾配電界発生用電極1、2に電圧を印加し、この状態で、外部からの液体13を、液体供給流路14の液体流入口15から流体容器11の強電界部6と弱電界部7のほぼ中間位置に供給する。

【0020】すると、勾配電界発生用電極1、2間には電界が発生され、該電界によって図5に示すように、流体容器11内の液体13に混入された気泡12が誘電分極されるが、前記電界は、勾配電界発生用電極1、2間の間隔が狭くなっている一側が強電界部6となり、間隔が広がっている他側が弱電界部7となる勾配電界8であるため、誘電分極された気泡12に誘電泳動力が作用し、該電気泳動力によって気泡12が弱電界部7側へ移動されて、液体13から分離される。

【0021】このようにして分離された気泡12は、弱電界部7側に設けられた格子状部材22の細かい目によって捕集される。

【0022】すると、宇宙空間では、格子状部材22がない場合に、図7に示すように、気体19と液体13との境界面24が、表面張力によって球面状で且つ不安定な状態となって気体19の取出しが困難となるが、格子状部材22を設けることにより、ほぼ平坦で且つ安定した境界面24が得られるので、弱電界部7側に設けられた気体排出口21から気体排出流路20を介して気体19を確実に外部へ排出させることが可能となる。

【0023】一方、気泡12が除去された液体13は、気泡12とは反対方向の電気泳動力を受けて強電界部6側に集るので、強電界部6側に設けられた液体排出口18から液体排出流路17を介して、気泡除去液16を確実に外部へ排出させることが可能となる。

【0024】又、勾配電界発生用電極1、2の端部や側部においては、図5に示すように、電気力線に乱れが生\*

\* じるので、勾配電界発生用電極1、2の長手方向23及び幅方向3の寸法を大きく取った方が、より安定して気泡12を除去させることができるようになる。

【0025】尚、本発明は、上述の実施例にのみ限定されるものではなく、本発明の要旨を逸脱しない範囲内において種々変更を加え得ることは勿論である。

【0026】

【発明の効果】以上説明したように、本発明の気泡除去装置によれば、容器内の液体から気泡を確実に分離して、液体のみを取り出すことができるという優れた効果を奏し得る。

【図面の簡単な説明】

【図1】本発明の一実施例の破断した側面図である。

【図2】図1のI-I矢視図である。

【図3】図1のI-I-I矢視図である。

【図4】勾配電界発生用電極の斜視図である。

【図5】気泡が誘電泳動によって移動される様子を示す作動図である。

【図6】格子状部材を設けた場合の気液境界面の様子を示す側面図である。

【図7】格子状部材を設けない場合の気液境界面の様子を示す側面図である。

【符号の説明】

1、2 勾配電界発生用電極

4 傾斜部

6 強電界部

7 弱電界部

8 勾配電界

11 流体容器

13 液体

14 液体供給流路

15 液体流入口

16 気泡除去液

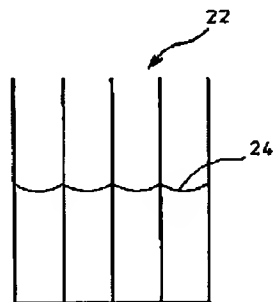
17 液体排出流路

18 液体排出口

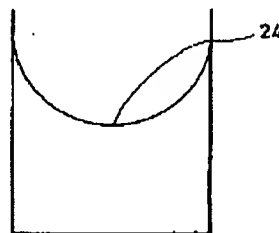
20 気体排出流路

21 気体排出口

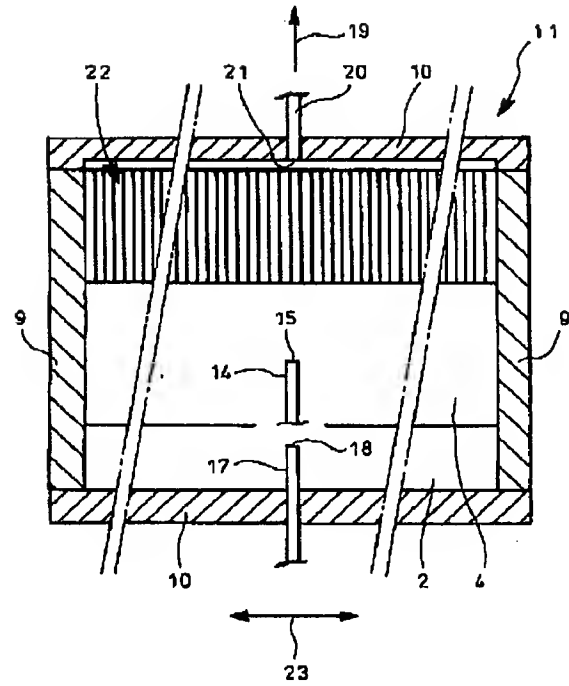
【図6】



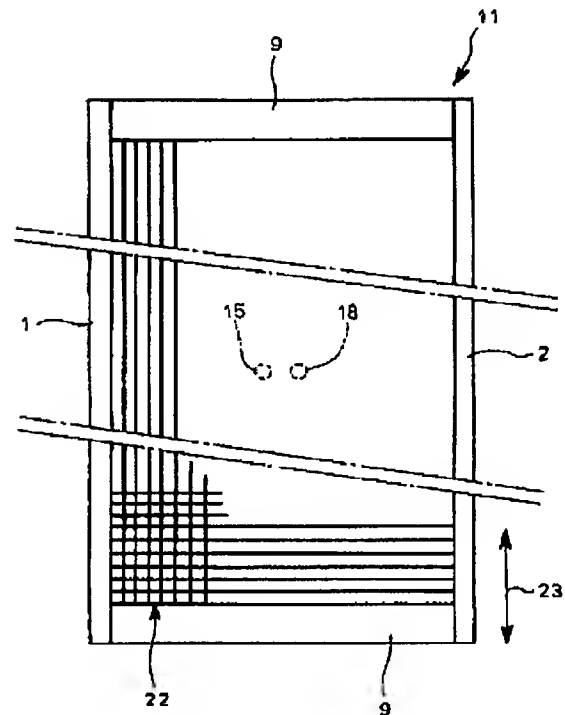
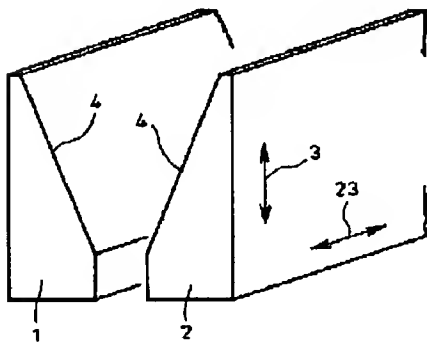
【図7】



【図 2】



【図 4】



(5)

特開平6-262005

【図5】

